

## ORIGINAL ARTICLE

# Motor vehicle crash pedestrian deaths in New York City: the plight of the older pedestrian

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**Objective:** To describe the epidemiology of pedestrian deaths due to motor vehicle crashes (MVCs) between age groups in New York City (NYC), with a comparison to national data.

**Methods:** Review of MVC pedestrian deaths in NYC and the US from 1998 to 2002. Data on deaths were obtained from the National Highway Traffic Safety Administration.

**Results:** Almost half (48%) of all MVC deaths in NYC were among pedestrians, compared with 12% nationally. Pedestrian death rates were highest among older age groups ( $\geq 65$  years). NYC's older pedestrians were more likely than US older pedestrians to be killed at an intersection, during daytime and on weekdays.

**Conclusion:** Older people constitute a major proportion of MVC pedestrian deaths in NYC. Conditions (such as traffic exposure) surrounding pedestrian MVCs may differ by age group. The high burden of MVCs among older pedestrians in NYC highlights the importance of local-level analysis to guide public health planning.

Pedestrian deaths from motor vehicle crashes (MVCs) are a major public health problem. In the developing world, more people die from MVCs while outside of the motor vehicle (walking or bicycling) than inside the motor vehicle.<sup>1</sup> In the US, the opposite is true; pedestrians account for about 12% of MVC deaths.<sup>2</sup> In large cities with populations greater than 1 million, pedestrian deaths account for 35% of MVC deaths.<sup>3</sup>

Although children have been a major focus of pedestrian injury prevention at the national<sup>4</sup> and local levels, in the US, older adult pedestrian death rates surpass child pedestrian death rates.<sup>5</sup> Older pedestrians may have less exposure—walk less and cross fewer streets—yet experience higher risk.<sup>6</sup> DiMaggio and Durkin<sup>7</sup> described pedestrian injury among children and adolescents in NYC and found differences in crash factors even among young age groups. As older people became a larger subset of the NYC<sup>8</sup> and US population,<sup>9</sup> pedestrian MVCs among this group warrant particular attention, especially in large urban centers where pedestrian deaths comprise a substantial portion of MVC deaths. NYC's pedestrian MVC deaths differ from national patterns and provide an example of how MVC risk factors differ at the local level, highlighting the need for local intervention policies.

## METHODS

Pedestrian deaths from 1998 to 2002 described here were extracted from the Fatality Analysis Reporting System database of the National Highway Traffic Safety Administration. The Fatality Analysis Reporting System database is a compilation of all MVCs in the US that resulted in death of a motor vehicle occupant or non-occupant within 30 days of the crash. Data are available at the national, state and county levels, and are based on the location of the crash. It is compiled from police crash reports, state vehicle registration files, state driver licensing files, State Highway Department data, vital statistics and death certificates.<sup>10</sup> Census 2000 data were used to determine death rates.<sup>8,9</sup>

Pedestrians are people involved in a MVC who were not riding in or on a motor vehicle at the time of the crash. Bicyclists are not included in this analysis.

Age-specific pedestrian death data of NYC were compared with national data. In NYC, pedestrian death rates were compared between age groups, and additional crash factors, such as pedestrian location at time of crash, time of day and whether the victim was taken to a hospital were compared across age groups.

## RESULTS

### Fatal pedestrian MVCs in NYC and the US

Every year, there are about 5000 pedestrian deaths in the US and about 200 in NYC due to MVCs (table 1). From 1998 to 2002, pedestrians comprised 48% of all MVC deaths in NYC (887 of 1849) compared with 12% of MVC deaths nationally (24 682 of 210 364). In NYC, pedestrian deaths did not vary considerably over time, ranging from a low of 163 in 2002 to a high of 186 in 2001. Nationally, people aged  $\geq 65$  years constituted 12% of the total population and 22% of the pedestrian deaths. In NYC, 38% of pedestrian deaths were among people aged  $\geq 65$  years, although this group comprised the same 12% of the population.

Age-specific death rates varied most between the youngest and oldest age groups. In NYC, the death rate for the oldest age group ( $\geq 85$  years) was 11 times higher than for the youngest age group, birth to 14 years. Differences in age-specific death rates were not as pronounced nationally (table 1). Although people aged  $\geq 65$  years had higher age-specific death rates than those aged  $\leq 65$  years, nationally (3.1/100 000 v 1.5/100 000) and in NYC (7.2/100 000 v 1.5/100 000), older pedestrian death rates in NYC were 4.8 times higher than the younger age group.

Men accounted for most of the pedestrian deaths; both nationally<sup>10</sup> and in NYC, comprising 69% and 61% of these deaths, respectively. Male pedestrians tended to be younger and had higher death rates than female pedestrians for all age groups. For the oldest men aged  $\geq 85$  years, the death rate was almost five times higher than the death rate of the oldest women. Despite having higher death rates for each age group examined, a higher proportion of deaths occurred among older women than among older men. Almost

**Abbreviations:** MVCs, motor vehicle crashes; NYC, New York City

**Table 1** Motor vehicle crash pedestrian death averages in New York City and the US, Fatality and Analysis Reporting System, 1998–2002

Age groups (years)	USA—all pedestrians		NYC—all pedestrians		NYC—males		NYC—females	
	Avg/year	Rate/100 000*	Avg/year	Rate/100 000**	Avg/year	Rate/100 000††	Avg/year	Rate/100 000**
0–14	475	0.8	14	0.9	9	1.1	5	0.6
15–24	577	1.5	13	1.2	8	1.5	5	0.9
25–34	616	1.5	15	1.1	11	1.7	4	0.6
35–44	900	2.0	23	1.8	17	2.7	6	0.9
45–54	756	2.0	22	2.2	16	3.4	6	1.2
55–64	488	2.0	18	2.6	11	3.5	7	1.9
65–74	437	2.4	25	5.0	13	6.0	12	4.2
75–84	463	3.7	30	9.5	12	10.1	19	9.1
≥85	179	4.2	12	10.3	8	23.4	4	5.1
Unknown/blank	46	n/a	5	n/a	4	n/a	1	n/a
Total	4936	1.8	177	2.2	107	2.8	70	1.7
<65	3812	1.5	105	1.5				
≥65	1078	3.1	68	7.2				

\*On the basis of Census 2000.

††On the basis of Census 2000 and population estimates for intercensal years.

one-third (30%) of male pedestrian deaths were among those aged ≥65 years compared with 50% of female pedestrian deaths in this age group.

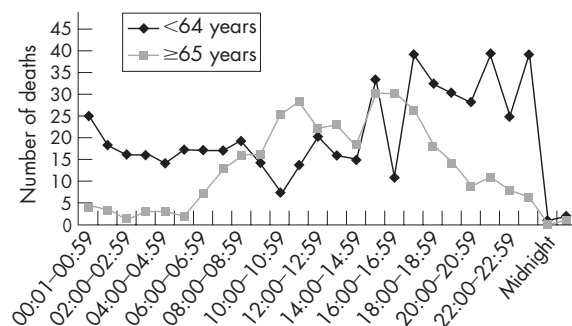
### External conditions affecting fatal pedestrian MVCs in NYC

In the US, most pedestrian deaths occurred at non-intersections. From 1998 to 2002, 78% (19 256 of 24 682) of MVC pedestrian deaths in the US occurred at non-intersections.

This was not the case for NYC and particularly not for older pedestrians in NYC. Fifty seven percent of pedestrian deaths occurred at intersections; generally, the older the pedestrian, the more likely they were killed at an intersection (table 2). For example, in NYC, 44% of pedestrians aged 25–34 years were killed at an intersection compared with 72% of 75–84 year olds. In comparison, for US deaths, 13% (399 of 3080) of pedestrians aged 25–34 years and 36% (822 of 2315) of 75–84 year olds were killed at intersections.

About 2–3 of all pedestrian deaths occurred in the post meridian hours (12:00 noon to 11:59 pm) in NYC and the US.<sup>10</sup> However, in NYC about 73% of the older pedestrian fatal MVCs occurred between 7:00 am and 5:59 pm. In the US, 52% of all older pedestrians were killed in crashes at this time. Early morning and late evening fatal pedestrian crashes were more likely to involve younger pedestrians, <65 years old (fig 1).

For people aged ≥65 years, fatal pedestrian MVCs in NYC occurred more often on weekdays than on weekends. For

**Figure 1** Motor vehicle pedestrian crash deaths in New York City—crash time of day by age group—Fatality Analysis and Reporting System, 1998–2002.

example, older adults comprised 41–46% of the deaths for each day, Monday to Friday. In comparison, older adults comprised 26% and 20% of the pedestrian deaths on Saturday and Sunday, respectively. Similar to NYC, older pedestrian deaths in the US comprised a smaller proportion of deaths on the weekends (16% on Saturday and 15% on Sunday). However, older US pedestrians comprised no more than 28% of the pedestrian deaths on any day of the week (data not shown).

Once struck by a motor vehicle, older pedestrians were more likely than younger pedestrians to be taken to hospital, with 88% of the older pedestrians being taken to hospital before dying from their injuries. This is in comparison to 81% of those <65 years. In the US, 70% of the older pedestrians and 54% of younger pedestrians made it to hospital alive.

### DISCUSSION

In contrast with national characteristics of MVCs, almost half of all MVC deaths in NYC were among pedestrians. NYC also had a greater disparity of age-specific death rates between the youngest and oldest age groups than the nation as a whole, and pedestrians aged ≥65 years had a particularly high death rate. Previous research suggests that older pedestrians may be more likely to die than younger pedestrians if struck by a motor vehicle.<sup>11</sup> Older pedestrians who survive initial crashes and are taken to the hospital are also more likely to die in the hospital and experience “metabolic, infectious or surgical complications of injury.”<sup>11</sup> Although this explains higher death rates among the older pedestrians in general, the higher death rate among older pedestrians in NYC may be a function of more crashes in that population.

**Table 2** Motor vehicle crash pedestrian deaths in New York City—pedestrian location at time of crash by age group, Fatality Analysis and Reporting System, 1998–2002

Age group (years)	Intersection (%)	Non-intersection (%)	Total
0–14	27	39	61
15–24	29	45	55
25–34	34	44	56
35–44*	57	50	48
45–54	63	57	43
55–64	49	54	41
65–74	78	63	37
75–84	109	72	28
≥85	43	69	19
Unknown	14	56	11
Total*	503	57	382

\* Two deaths with unknown location not shown above.

## Key messages

- Pedestrians comprise a major portion of Motor vehicle crash (MVC) deaths in large cities and warrant detailed local-level analysis to guide public health planning.
- In New York City (NYC), pedestrians accounted for almost half of MVC deaths.
- Thirty eight percent of the pedestrians killed in NYC were aged  $\geq 65$  years, whereas 22% of US pedestrian deaths were among older adults.
- About 73% of older pedestrian fatal crashes in NYC occurred between the hours of 7:00 am and 5:59 pm, compared with 52% of fatal crashes in the US among the older age group.
- Older adults in NYC accounted for 41–46% of deaths during weekdays, compared with US pedestrians who comprised no more than 28% of weekday deaths.

Older pedestrians in NYC were more likely to be killed at an intersection than at a non-intersection. Intersection crashes suggest that these crashes may have occurred at slower speeds, which suggest less severe injuries overall. Also, older pedestrians may be following the rules and not crossing the streets at mid-block, but previous research suggests that because of physical changes owing to age, older pedestrians take longer to cross the street, which may put them at increased risk irrespective of where they cross.<sup>12</sup> However, other research suggests that crosswalks may give elderly people a false sense of security when crossing the street, particularly at intersections with crosswalk markings but without a stop sign or signal.<sup>13</sup> Although crosswalks are more likely to be present at intersections, our data did not indicate if a signal was present or which of the intersections had crosswalks. Further research is needed to look at the characteristics of the intersections and crosswalks where older pedestrians died.

Although wearing light-colored clothing is recommended for pedestrians, especially at night,<sup>14</sup> older pedestrians in NYC were more likely to be fatally injured during daylight. This suggests that visibility may not be the primary factor affecting MVC deaths in older pedestrians, but may also mean that older pedestrians are more likely to be walking during daytime hours. Similarly, a higher proportion of older pedestrian deaths on weekdays compared with weekends could reflect the likelihood that younger age groups that comprise a larger share of the population are more likely to be indoors during the average work or school week.

This paper did not examine any temporal changes of pedestrian deaths relative to occupant deaths. Also, actual exposure to traffic conditions by age group was not available. Similarly, exposure to traffic by sex was not available, but some of the differences between older men and women could be attributed to the greater number of older women compared with older men. Data on exposure would further identify sex and age groups at highest risk of pedestrian death.

## CONCLUSION

These data must be viewed in the context of demographic changes in NYC. Comparing the 1990 and 2000 Census showed that although there was a slight decrease (–1.6%) in the number of residents in NYC aged  $\geq 65$  years, the population of people aged  $\geq 85$  years increased by 18.7%.<sup>8</sup> Efforts to reduce motor vehicle pedestrian deaths and injuries must be tailored and targeted to the appropriate groups and

their particular risk factors. More than one type of intervention may be needed to deal with this problem.

While examining the age distribution of pedestrian deaths, it is important to remember that the focus of interventions must be on modifiable factors (eg, older pedestrians may more likely to die from less severe injuries owing to physiological factors that cannot be changed). Changes to the environment have been shown to reduce pedestrian MVCs. One such modification that may be beneficial for older pedestrians is automatic pedestrian detection—devices that can increase the amount of crossing time allowed at particular crosswalks. This may be an important consideration especially in neighbourhoods with large populations of elderly people.<sup>3</sup> Other modifications and interventions may include multiway stop-sign controls, changing the timing of traffic signals and modifying roadway characteristics.<sup>3</sup> Enforcement of traffic laws, particularly those controlling vehicle speed, can reduce pedestrian deaths. This may be of particular importance for older pedestrians, who are even more susceptible to death from vehicles at greater speeds than younger pedestrians.<sup>15</sup> Education interventions are an important part of any injury control effort. Education can cost less than changing the environment.<sup>16</sup> Although education has not been shown to reduce older pedestrian injury, there have been no controlled trials of adults in the general population.<sup>17</sup> Pedestrian safety can be viewed not only as a public health issue but also as part of a larger urban affairs context. Pedestrian safety can serve as a part of neighborhood revitalisation efforts,<sup>16</sup> which benefit all ages.

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